Math F412: Homework 9 **Due: April 1, 2005**

These problems from do Carmo:

- 3-2: #3, #4

As well as:

1. Compute the second fundamental form of the helicoid in the coordinates defined by the chart $\sigma(u,v) = (v\cos(u), v\sin(u), u)$.

2. Compute the normal and geodeisc curvature of the lines of latitude of the unit sphere.

3. Suppose S is an orientable surface and that $\sigma : \mathbb{R}^2 \to S$ is a chart such that the second fundamental form in these coordinates vanishes. Prove that $\sigma(\mathbb{R}^2)$ is contained in a plane. (This is a version for surfaces of the fact that if a curve has vanishing curvature, then it's trace is contained in a line).

Hint: Use the fact that

$$\frac{d}{du} N(\sigma(u,v)) = DN_{\sigma(u,v)}(\sigma_u(u,v))$$

and so forth (along with the definition of the second fundamental form) to show that the normal vector is constant.

See me for more hints if need be!